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Utilization of

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Sycamore

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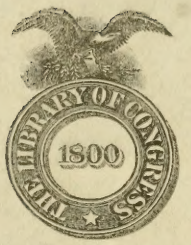

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 884

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WILLIAM B. GREELEY, Forester

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UTILIZATION OF SYCAMORE.

By W. D. Brush, *Scientific Assistant.*

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IMPORTANCE.

Sycamore is one of the important commercial woods of the United States, and is of special value for use in certain containers, such as slack barrels and plug-tobacco boxes. It ranks low, however, in amount consumed, for about 25 native woods, including 13 hardwoods, are used in larger quantities.

This bulletin gives information on the supply of sycamore, on the conditions attendant on its manufacture, and on how it may be used most advantageously.

THE WOOD.

GENERAL APPEARANCE.

Sycamore, in general, is a uniformly colored, clean-looking wood, and therefore presents a good appearance when manufactured. The heartwood is brown tinged with red; the sapwood is lighter. Plain-sawed sycamore has little figure, excepting the lighter-colored bands which mark off the annual-growth layers from each other. It usually

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TABLE 1.—*Actual and comparative properties of sycamore (Platanus occidentalis) wood.*

Locality where grown.	Weight per cubic foot.			Specific gravity, oven-dry, based on volume when green.	Shrinkage from green to oven-dry condition.			Strength in bending.		Strength in compression parallel to grain.	
	Green.[1]	Air-dry.[2]	Kiln-dry.[3]		In volume.	Radial.	Tangential.	Modulus of rupture.	Relative strength compared with oak (oak=100).	Maximum crushing strength.	Relative strength compared with oak (oak=100).
	Pounds.	*Pounds.*	*Pounds.*		*Per cent.*	*Per cent.*	*Per cent.*	*Lbs. per sq. in.*		*Lbs. per sq. in.*	
Hendricks County, Ind.	51	35	34	0.45	13.5	5.0	7.3	6,300	72.9	2,790	79.0
Sevier County, Tenn.	53	36	35	0.46	14.8	5.2	7.9	6,640	76.9	3,060	86.7

Locality where grown.	Strength in compression perpendicular to grain.		Stiffness.		Hardness.		Shock-resisting ability.		Shearing strength parallel to grain.	
	Fiber stress at elastic limit.	Relative strength compared with oak (oak=100).	Modulus of elasticity in bending.	Relative stiffness compared with oak (oak=100).	Load required to embed a 0.44-inch ball one-half its diameter.	Relative hardness compared with oak (oak=100).	Work to maximum load in bending.	Relative shock-resisting ability compared with oak (oak=100).	Shearing strength.	Relative shearing strength compared with oak (oak=100).
	Lbs. per sq. in.		*1,000 lbs. per sq. in.*		*Pounds.*		*Inch-lbs. per cu. in.*		*Lbs. per sq. in.*	
Hendricks County, Ind.	433	59.6	964	73.5	580	55.3	7.1	53.4	1,001	77
Sevier County, Tenn.	468	64.4	1,166	88.9	638	60.9	7.9	59.4	990	76

[1] Average green material.
[2] About 12 or 15 per cent moisture. Average condition reached without artificial heating by material sheltered from precipitation, North Central States.
[3] About 8 per cent moisture.

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has also a slightly mottled appearance, due to the large medullary rays. In quarter-sawed wood these rays are very conspicuous and resemble the figure in quartered oak. The effect produced in quarter-sawed sycamore is decidedly different, however, from that in quarter-sawed oak, principally because the rays are darker than the rest of the wood, while in oak, as in most other woods, they are lighter. Sycamore takes several different finishes in a very attractive manner.

PROPERTIES.

Sycamore wood is moderately hard, moderately heavy, moderately stiff, moderately strong, has moderately good shock-resisting ability, and is difficult to split. It shrinks moderately and is inclined to warp, but not excessively, in seasoning. Table 1 gives the results of a large number of tests on sycamore wood from two different localities. Material for these tests was taken from five trees in each locality.

From Table 2 it appears that on the average sycamore shrinks a little more than white oak in the radial direction, a trifle less in volume, and considerably less in the tangential direction. The ratio of radial to tangential shrinkage is much less in sycamore (1 to 1.49) than in white oak (1 to 1.84).

TABLE 2.—*Average properties of sycamore wood as compared with white oak.*

[Oak=100.]

	Per cent.
Specific gravity	76.7
Shrinkage:	
Volume	99.3
Radial	104.1
Tangential	84.4
Strength in bending	75.2
Strength in compression parallel to grain	82.7
Strength in compression perpendicular to grain	61.9
Stiffness	80.9
Hardness	58.2
Shock-resisting ability	56.4
Shearing strength parallel to grain	76.6

The specific gravity of dry sycamore is only about three-fourths that of white oak. Although in respect to the different mechanical properties sycamore ranks lower than white oak, compared on the basis of dry weight, or specific gravity when dry, sycamore excels the oak in strength in compression parallel to the grain, and in stiffness; is about equal to it in shearing strength parallel to grain and strength in bending; and is below it in strength in compression perpendicular to grain, hardness, and shock-resisting ability.

Sycamore wood is not durable, the average life of the untreated lumber in the United States in exposed situations being placed at from three to five years. The life of any individual stick, however,

may vary from this figure, depending on the quality of the wood and the conditions in which it is placed.

Sycamore does not impart odor or taste to substances in contact with it, nor does it stain them. This quality, together with its moderate degree of strength and the difficulty in splitting the wood, makes it particularly suitable for certain kinds of containers.

TABLE 3.—*Average computed weight (in pounds) of sycamore in different forms.*

	1-inch lumber, per 1,000 feet, b. m.	Cord, 90 cubic feet (solid wood).	Doyle log rule.				Scribner log rule.			
			Diameter of logs—inches.				Diameter of logs—inches.			
			6	12	18	24	6	12	18	24
			1,000 feet, log scale.				1,000 feet, log scale.			
Sycamore, green	4,300	4,700	55,600	12,000	8,400	7,100	12,400	9,700	7,700	7,000
Sycamore, air-dry	3,000	3,200	38,000	8,200	5,700	4,800	8,400	6,600	5,300	4,800

Table 3 gives the average computed weight of 1,000 board feet of 1-inch lumber, of a cord of wood, and of logs per 1,000 board feet as scaled by the Doyle and Scribner log rules. The cord used in this table is composed of 90 cubic feet of solid wood. The official standard weight of the National Hardwood Lumber Association for rough sycamore lumber 1 inch thick is 3,000 pounds per 1,000 board feet, which corresponds with the computed weight of 1-inch air-dry lumber as shown in the table. The standard weight of the Association for green sycamore lumber 1 inch is 4,750 pounds per 1,000 board feet.

STRUCTURE.

Sycamore is a "diffuse porous" wood; that is, the pores or vessels of the wood are all nearly the same size and quite evenly distributed

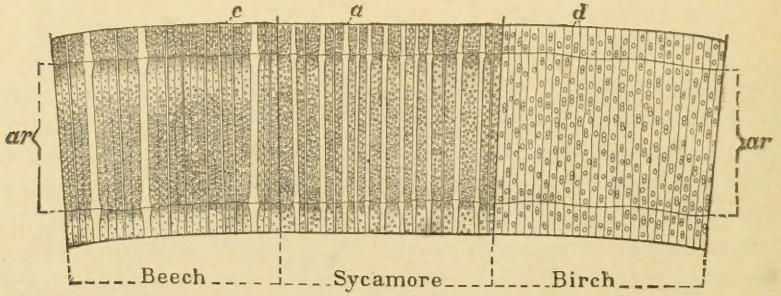


FIG. 1.—Wood of beech, sycamore, and birch. *a*, broad ray of sycamore; *c*, *d*, narrow ray of beech and birch; *ar*, annual ring.

throughout each annual layer or ring of growth, and the annual rings are marked off from each other by light-colored lines. The medullary rays are numerous and conspicuous and practically all

broad. Figure 1 shows the differences in structure in beech, sycamore, and birch, which are all diffuse porous woods. In beech, as in sycamore, there are broad rays; but in beech there are many narrow rays and the broad rays are unevenly spaced, whereas in sycamore they are evenly spaced. In birch the rays are all narrow. Plate I is a photograph of a cross section of sycamore wood.

SUPPLY AND DEMAND.

RANGE AND SIZE OF TREE.

Practically all of our native sycamore wood comes from a single species, *Platanus occidentalis*, which grows throughout nearly all of the eastern half of the United States (fig. 2). Other names applied to the tree are buttonwood and buttonball. Two other species occur in the western part of the United States, but these are unimportant commercially, yielding only a small amount of timber for local purposes. The common eastern sycamore usually grows to a height of from 75 to 110 feet and a diameter of from 2 to 5 feet. There are records of sycamores measuring up to 14 feet in diameter and 140 feet in height, and a few such trees are still found. It is, therefore, the largest hardwood of the United States in size of trunk, but not in height.

Sycamore trees do not, as a rule, yield a large amount of the highest quality timber because of the shortness of the clear length of stems. Large logs are frequently shaky and often hollow, and on this account there is a high percentage of waste in the manufacture of lumber and veneer. Logs over 20 inches in diameter are likely to be very defective. Smaller second-growth logs are usually quite sound. The southern sycamore is said to be often badly affected with worm holes, which makes it unsuitable for most uses. (See Pl. II.)

COMMERCIAL SUPPLY.

The principal supply of sycamore is from that part of the central hardwood region which includes West Virginia and Missouri, the States lying between them, and Arkansas and Tennessee. The greatest supply of sycamore is located along river bottoms in the Ohio and Mississippi Valleys and along the large streams tributary to these rivers.

The principal center of the sycamore industry seems to be at present located near the junction of the Ohio and Mississippi Rivers. Much sycamore is available in this region along these streams and their large tributaries, and, therefore, many factories using large amounts of sycamore are located near by. The factories are usually located on the rivers and get their sycamore logs in rafts. The logs are placed in the water at different points along the streams, and are collected by a man with a power boat, who assembles them into rafts and tows them to the factory. Considerable quantities

of sycamore are secured in this way along the lower Tennessee and Cumberland Rivers. Factories located on the lower Ohio River can usually get a sufficient supply for their needs. In other regions, however, factories seeking large amounts of sycamore are generally unable to get a sufficient quantity and have been greatly inconvenienced by lack of a steady supply. In most cases such factories have been obliged to a considerable degree to substitute other woods for sycamore.

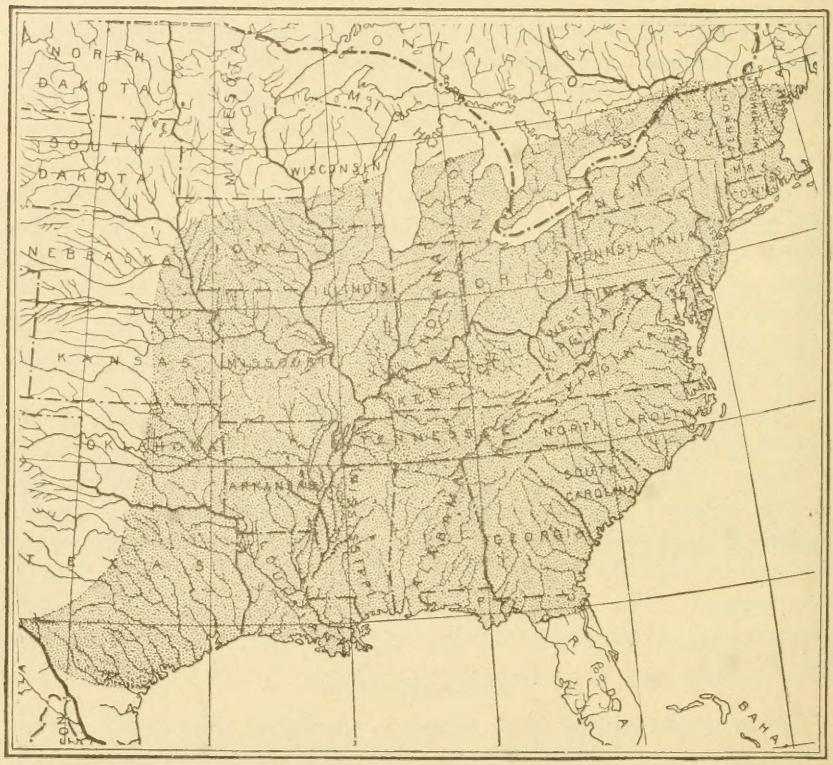


FIG. 2.—Distribution of the sycamore tree (*Platanus occidentalis*).

Sycamore timber is so widely scattered and in compact bodies so small that an accurate estimate of the stand is impossible. Sycamore is a bottom-land tree, and its favorite habitat is along river banks and on islands which rise above the surface of the water at low stages. The tree, is thus doubly useful in protecting river banks from washing and in providing useful timber. Its choice of location is a strong factor in keeping up the supply, since it grows extensively on land which is unsuitable for cultivation. There is, of course, less sycamore in the country than there was before the fertile valleys were cleared. A future limited supply is assured, however, from areas that are not useful for agricultural purposes.

TABLE 4.—*Output of sycamore lumber, by States, in 1899 and 1904, and from 1907 to 1918, inclusive; average value of the product, f. o. b. mills; and number of mills reporting.*

State.	1899	1904	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Total number of mills reporting	31,833	[1] 18,277	28,850	31,231	[2] 46,584	[1] 31,934	[1] 28,107	[1] 29,005	[1] 21,668	[1] 27,506	[1] 16,815	[1] 17,269	16,420	14,765
Total number of mills cutting sycamore	([3])	([3])	1,505	2,079	2,964	[4] 2,325	1,904	2,211	659	603	876	931	904	775
Average value per 1,000 board feet, f. o. b. mill	$11.03	$13.15	$14.58	$14.67	$14.77	$14.10	$13.16	([3])	([3])	([3])	$13.86	$14.65	$18.68	$23.59
	1,000 bd. ft.	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*	*1,000 bd. ft.*
Computed total cut of sycamore											25,000	40,000	62,000	30,000
Total reported cut	29,715	18,002	46,044	43,332	56,511	45,063	42,836	49,468	30,804	22,773	19,729	28,035	28,548	26,283
Arkansas	455	2,612	5,570	4,000	5,406	5,570	6,617	7,538	11,663	3,404	4,645	7,231	8,455	6,437
Indiana	8,733	8,329	11,129	10,447	11,003	8,433	7,109	7,850	3,519	3,803	3,309	3,958	3,964	3,457
Tennessee	3,437	572	3,999	2,914	3,512	5,026	5,855	6,956	3,586	3,744	2,739	3,680	4,869	3,162
Missouri	5,706	1,757	7,507	6,708	10,526	7,793	8,617	8,223	3,840	2,229	2,144	1,789	1,535	2,773
Ohio	4,134	1,277	3,291	4,165	5,243	4,139	3,493	3,104	2,018	1,529	1,522	1,827	1,423	1,868
Illinois	4,412	1,605	5,822	3,495	5,073	2,913	2,153	3,249	1,309	1,674	559	1,297	1,501	1,730
Mississippi	10	195	20	342	379	885	1,182	257	25	129	333	499	824	1,714
Kentucky	1,880	680	7,025	5,137	6,760	4,711	3,625	4,837	2,652	2,693	1,678	1,933	1,796	1,518
Louisiana			32		94	85	98	180	143	281	195	374	774	1,075
Oklahoma	1	160	300	1,715	2,353	1,612	1,192	2,043	413	1,178	237	466	499	638
Virginia	238		360	468	980	749	606	757	177	299	294	526	1,364	593
Georgia				220	80	162	76	110	315	376	149	355	275	321
Maryland			30	364	904	254	182	429	52	391	271	383	446	250
Alabama		575		115	419	207	124	794	33	117	225	90	107	202
Michigan	504	50	68	503	749	732	379	579	67	34	104	135	107	135
West Virginia	5		816	1,838	1,533	793	513	1,155	274	152	250	2,360	239	115
Pennsylvania		70	39	753	562	533	525	575	202	119	95	212	120	105
North Carolina			11	9	221	109	120	369	141	324	245	413	100	58
Texas				4	59	71	125	125	5		291	33	65	35
South Carolina		100	5	6	10	49	28	17	190	192	203	282	20	30
Connecticut			20	22	10	5	20	45	125	1	26	5	2	16
New York	70					18	16	1	5	74	87	77	14	9
New Jersey				36	15	44	2	51	15		22	4	5	9
Florida							5	9			6			
Delaware										25				
Massachusetts				20	6	1		5						
New Hampshire								4						
Vermont							20							
All other States [5]	130	20		51	614	169	154	206	35	5	100	106	44	33

[1] Mills cutting under 50,000 feet excluded.
[2] Includes 4,543 mills cutting less than 50,000 feet, and all cooperage, veneer, millwork, box, furniture, and other factories cutting any lumber at all in 1909.
[3] Data not obtained.
[4] Not including New York.
[5] Includes Iowa, Kansas, Nebraska, and Nevada.

LUMBER PRODUCTION.

Table 4 gives the reported production of sycamore lumber for different years by States. According to these figures, there has been a decided decrease in the cut in recent years. The decrease is not so great as appears from the figures, however, since the census reports subsequent to 1909 are not so complete as for that year, and a large number of small mills by which much of the supply of sycamore lumber is produced are not included in the later reports.

There is considerable fluctuation in the amounts of sycamore lumber produced by the same State in successive years. This is due, in part, to the transportation of logs by streams which form boundaries of different States in the sycamore region, the logs going sometimes to a mill in one State and sometimes to a mill in another State. The variation is also probably due to an irregularity in the supply, since the timber, being confined so largely to river bottoms, is logged mainly as timber operations chance to be carried on in such situations.

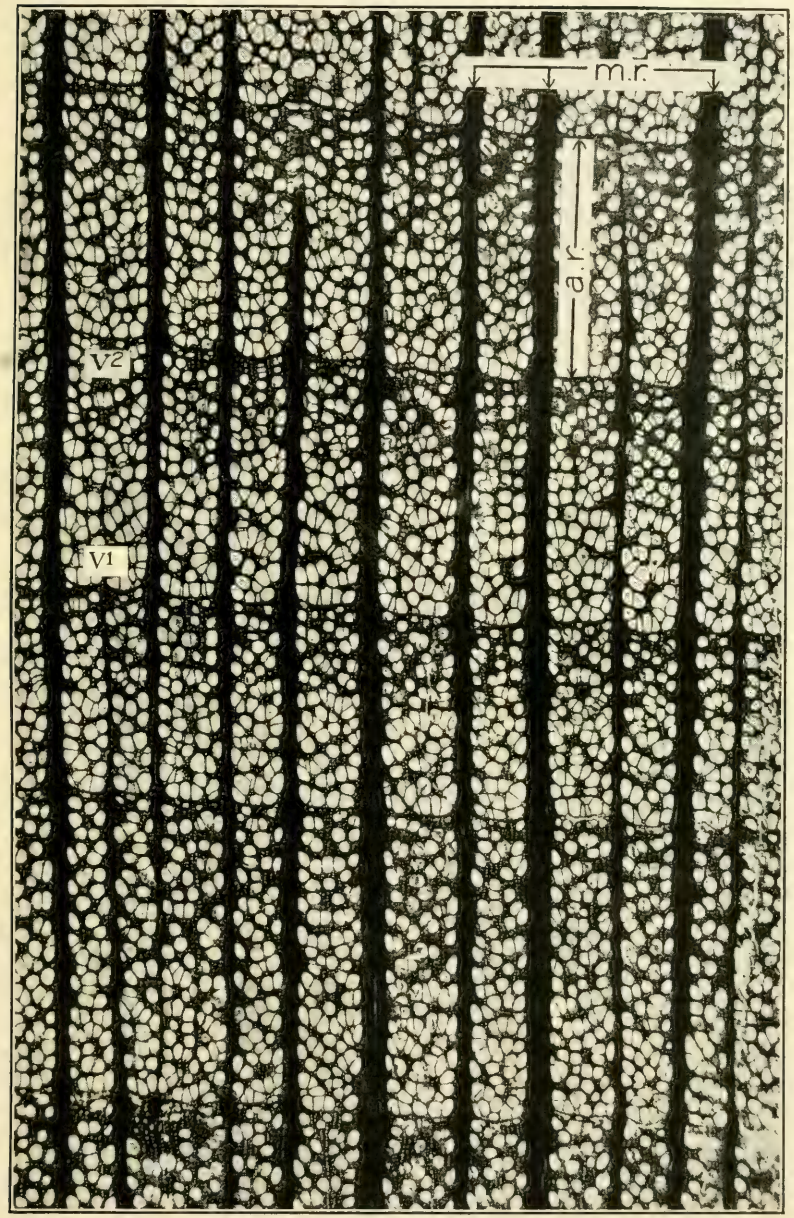
CONSUMPTION OF SYCAMORE.

Little sycamore is used in the rough for such purposes as building construction, ties, etc. It goes principally, therefore, to factories for the manufacture of various products. Considerable amounts are doubtless cut into firewood, but statistics are not available to show the extent of this use. Sycamore is widely distributed, and much of it is applied to general farm uses, although many other woods are more valuable for such purposes.

TABLE 5.—*Number of mills reporting lumber cut of sycamore in the different States, arranged in order of lumber cut in 1918.*

State.	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Total	[1] 1,505	2,079	2,964	[2] 12,325	1,904	2,211	659	603	876	931	904	775
Arkansas	25	51	83	58	60	62	31	31	42	55	59	54
Indiana	379	476	633	440	370	383	129	146	199	204	198	157
Tennessee	113	125	201	149	111	142	37	41	80	74	93	74
Missouri	233	286	501	410	373	415	140	66	104	95	87	71
Ohio	206	270	357	277	234	274	70	76	105	111	109	100
Illinois	217	230	279	199	167	209	64	65	47	48	43	38
Mississippi	*a*	17	29	30	11	15	4	8	10	14	32	27
Kentucky	248	301	338	327	254	303	84	48	94	107	88	93
Louisiana	*a*	.....	6	4	3	6	3	6	7	10	14	12
Oklahoma	*a*	47	80	67	50	60	15	33	17	18	14	14
Virginia	*a*	42	86	75	51	59	14	12	31	27	37	25
Georgia	.....	6	10	19	8	13	6	3	6	7	10	6
Maryland	*a*	29	36	29	16	26	5	19	29	24	19	18
Alabama	.....	11	22	14	14	18	*a*	9	13	16	12	9
Michigan	*a*	47	72	68	41	50	7	5	8	13	10	13
West Virginia	*a*	65	95	70	54	68	8	11	24	32	23	21
Pennsylvania	*a*	49	40	33	32	42	7	9	17	27	17	11
North Carolina	*a*	3	27	17	16	18	17	5	16	21	14	11
Texas	.....	*a*	4	4	4	5	*a*	.....	3	*a*	*a*	*a*
South Carolina	*a*	*a*	*a*	*a*	3	3	3	3	*a*	5	7	5
Connecticut	*a*	6	3	*a*	4	7	3	*a*	*a*	*a*	*a*	3
New York	.....	.....	.....	[3]	*a*	*a*	3	4	3	8	9	*a*
New Jersey	.....	5	4	7	*a*	*a*	*a*	.....	4	*a*	*a*	3
Florida	.....	.....	.....	.....	*a*	*a*	.....	.....	*a*	.....	.....	.....
Delaware	.....	.....	.....	.....	.....	.....	.....	*a*	.....	.....	.....	.....
Massachusetts	.....	*a*	*a*	*a*	.....	*a*	.....	.....	.....	.....	.....	.....
New Hampshire	.....	.....	.....	.....	.....	*a*	.....	.....	.....	.....	.....	.....
Vermont	.....	.....	.....	.....	*a*	.....	.....	.....	.....	.....	.....	.....
Iowa	.....	7	51	21	22	23	*a*	*a*	12	8	9	7
Kansas	.....	*a*	3	3	*a*	3	3	.....	.....	3	*a*	3
All other States [4]	84	6	4	4	6	7	6	3	5	4	7	5

[1] Not including New York.
[2] Number of mills cutting this species not reported.
[3] Including those marked "*a*."



PHOTOMICROGRAPH OF A TRANSVERSE SECTION OF SYCAMORE WOOD.

a. r., annual ring or yearly growth layer; V^1, vessels or pores of early or spring wood; V^2, vessels of late or summer wood; *m. r.*, medullary or pith rays which extend in the radial direction and give the figure in the quartered wood.

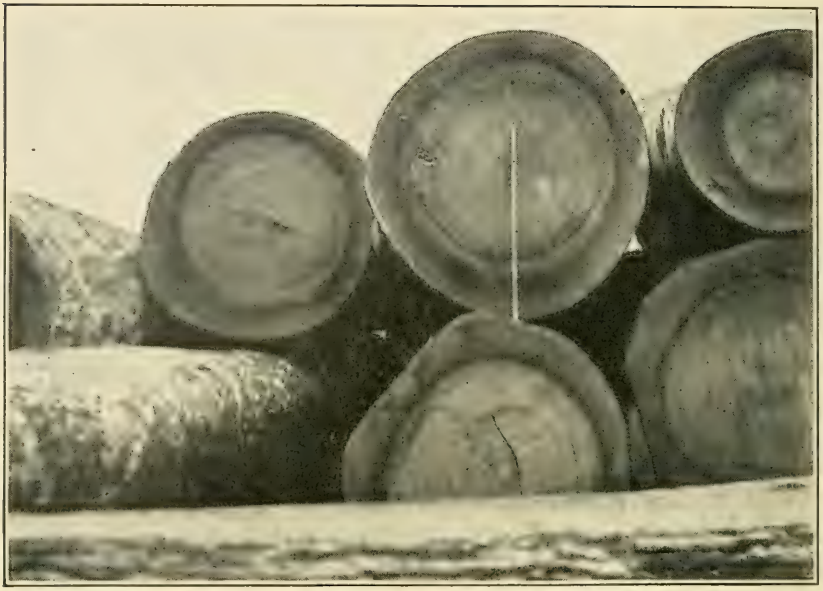


FIG. 1.—LARGE SYCAMORE LOGS IN A MILL YARD IN THE LOWER OHIO VALLEY.

Note the 2-foot rule. The three logs at the top are very sound for their size and are especially valuable for rotary veneer for tobacco boxes or baskets. The two lower logs show bad checks and ring shakes, and should be cut into lumber for furniture, etc.

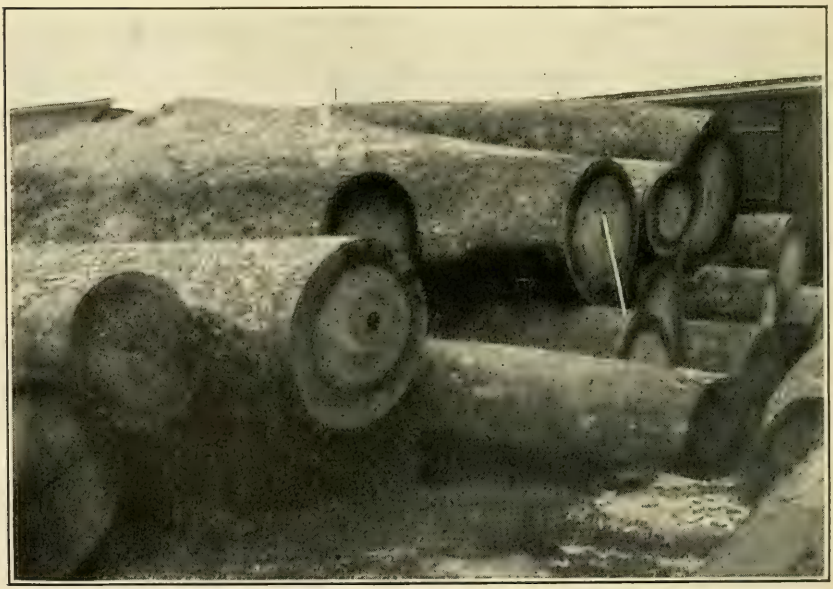


FIG. 2.—SYCAMORE LOGS OF DIFFERENT SIZES.

Two-foot rule at end of large log. Small sound logs are valuable for slack staves. Large logs are mostly defective, having rotten centers, deep checks, and ring shakes.

UTILIZATION BY INDUSTRIES.

Statistics were collected by the Forest Service during the years 1909 to 1913 on amounts of different woods consumed by factories. All industries using considerable amounts of sycamore were covered, with the exception of the slack cooperage industry. Statistics on the use of sycamore in this industry, prepared by the Bureau of the Census, are available for the year 1909. These data show a factory consumption of sycamore of over 33,000,000 board feet.

Sycamore is used in the largest quantities by those States which are in the immediate region of the greatest supply—namely, Kentucky, Missouri, Illinois, Arkansas, Indiana, and Tennessee. On account of the great tobacco industries located in Virginia and North Carolina, these States also use large amounts. Accurate figures on the amount used by each State can not be obtained, for the reason that some manufacturing firms have factories in different States. Certain quantities of sycamore lumber and plywood stock are shipped from one factory to another, and the amount used by each factory is not reported separately. It is estimated that about 90 per cent of all the sycamore used by factories is consumed in the eight States mentioned.

TABLE 6.—*Use of sycamore in factories in the United States, by industries. Compiled from reports for years between 1909 and 1913, inclusive.*

Industry.	Quantity used annually.	Per cent.
	Feet b. m.	
Boxes and crates	17,131,693	51.42
Slack cooperage	7,266,000	21.81
Furniture and fixtures	3,499,226	10.51
Planing-mill products: Sash, doors, blinds, and general millwork	1,723,550	5.17
Butchers' blocks	1,600,000	4.80
Musical instruments	301,600	.91
Agricultural implements	290,000	.87
Carpet sweepers	270,000	.81
Trunks	255,000	.77
Shade and map rollers	202,000	.61
Handles	156,000	.47
Sewing machines	150,000	.45
Woodenware and novelties	107,500	.32
Toys	91,343	.27
Brushes	71,500	.22
Vehicles and vehicle parts	62,600	.19
Ship and boat building	38,000	.11
Saddles and harness	34,500	.10
Sporting and athletic goods	30,500	.09
Frames and molding, picture	30,000	.09
Laundry appliances	2,000	.01
Total	33,318,812	100.00

Table 6 gives the quantities of sycamore used annually and the proportions, as reported by different wood-using industries. These figures are in terms of amounts consumed, except those for slack cooperage, which give the amounts produced. Since these data were compiled from reports for years between 1909 and 1913, inclusive, they do not represent accurately the present amounts used. They

do, however, show the relative importance of the different industries in sycamore utilization.

The largest amount of sycamore goes into the box and crate industry, and slack cooperage uses the next largest quantity. About three-fourths of the entire amount goes into these two industries. The use of sycamore for furniture and fixtures is an important one, the annual consumption being more than 10 per cent of the total. Two classes of uses (1) planing-mill products, sash, doors, blinds, and general millwork, and (2) butchers' blocks—each consumed about 5 per cent of the total. These five industries used about 94 per cent of the entire amount reported by factories.

From 100,000 to 300,000 board feet were consumed annually by manufacturers of each of the following: Musical instruments, agricultural implements, brooms and carpet sweepers, trunks and valises, shade and map rollers, handles, sewing machines, woodenware. The other eight industries given in Table 6—namely, toys, brushes, vehicles, and vehicle parts, ship and boat building, saddles and harness, sporting and athletic goods, picture frames and molding, and laundry appliances—used small amounts totaling only about 1 per cent of that reported for all industries.

The prices paid for sycamore by these different industries ranged from $12 per 1,000 board feet for butchers' blocks to $32 per 1,000 for carpet sweepers. In the case of the former, material was purchased in the log, and low-grade material could be used. For the latter, the quartered wood was largely used, and this brought a comparatively high price.

The average price paid for sycamore by manufacturers was $18 per 1,000 board feet. All prices are given f. o. b. factory. Reports on cost of raw material were not secured from slack cooperage plants, and the average cost of sycamore for such uses is, therefore, not available.

A list of products made of sycamore, arranged by industries, is shown in the appendix.

BOXES AND CRATES.

Sycamore is favored for boxes to hold certain products which are easily contaminated by contact with most woods. It has long been the favorite wood for boxes for plug tobacco, which is easily stained and acquires an unpleasant taste and odor from many woods. It is considered the most suitable wood for this purpose, not only because of its noncontaminating qualities but also because of its moderate degree of strength and its attractive appearance. More sycamore is used for boxes for plug tobacco than for any other product. Tobacco boxes were formerly made of solid wood and were nailed together, and sycamore served well because it did not split easily. Now, however, they are commonly made of plywood, glued together and lock-

cornered. Sycamore is well adapted for this also because it cuts well, makes a strong veneer, and glues well.

Red gum has largely displaced sycamore for tobacco boxes in recent years, chiefly on account of the scarcity of sycamore. Red gum not only does not contaminate the tobacco, but has the added advantage of cutting into plywood more easily, and therefore faster than the sycamore. The gum splits more readily, but this difficulty is obviated by lock-cornering in place of nailing. Red gum, however, does not make so attractive a box, and tobacco manufacturers have had considerable trouble in getting the trade to accept it because there was a suspicion that the grade of tobacco contained in the gum box was inferior. Sycamore is often used for the more conspicuous outer plywood pieces, but gum is being mixed with it more and more for such pieces, since the tobacco-box makers often can not get a sufficient supply of sycamore even for the outside ply.

Both red gum and sycamore are cut into veneer by the rotary process, the thickness depending on the box to be made from it. Tobacco boxes are usually made from thick ply. The veneer is cut into large sheets which are kiln-dried. There is less waste if the sheets are not put under pressure in the drying process, and for this reason they are dried on edge. After drying they are glued and held together under pressure until the glue is dry. On account of the greater warping of red gum there is greater resultant waste because of splits. This is more than compensated for, however, by the greater proportion of clear material obtained from large gum logs than from large sycamore logs, which are almost invariably defective. All sheets which have holes or checks running through them are thrown out. Those with small defects are glued together with clear pieces. Gum plywood stock is usually separated into light and dark grades, the lighter-colored wood giving the best appearance.

When thin ply is glued together, the grain in one sheet runs at right angles to that in the adjacent sheet. In thick ply, however, as one-quarter inch, the grain of the different sheets runs in the same direction. If glued with the grain running at right angles, such thick sheets are apt to pull apart. The sheets, as they are cut from the log, are glued together, face to face or back to back, in relation to the center of the log, so that the warping in one will be offset by that in the other, as it tends to take place in the same direction in the different sheets.

The caddy is one of the most common forms of tobacco box. This is square at the ends and is usually made of two-ply material about one-quarter inch thick and lock-cornered. Ordinarily, the only nails used are those in the strips which hold in the top and bottom heads. This makes a very strong box.

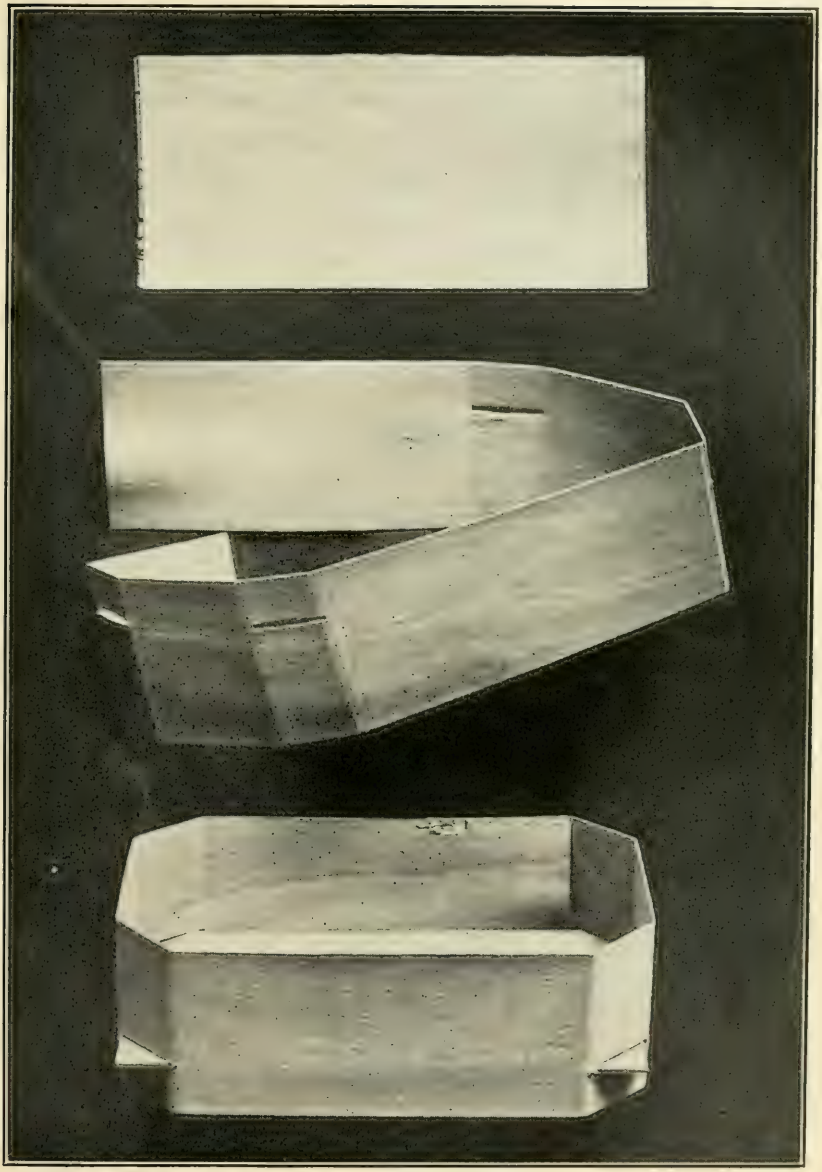
Tobacco boxes are also made of a single thickness of half-inch material strongly reinforced. They are made with inset bottoms and are usually nailed together by machines. Such boxes are often used for fine-cut tobacco, which is packed in them by machines.

Fruit and vegetable baskets and packages and egg cases are often made of sycamore. These are composed of thin veneer. Sycamore is favored because it veneers well, is clean-looking and uniformly colored, has considerable strength in this form, and is not so brash when dry as some woods, such as red gum, which are used in place of it. Beech and maple, however, are usually considered as satisfactory as sycamore. The veneered splints of the ordinary market basket and the bottom boards in bushels and half bushels are often made from sycamore in place of elm.

Basket makers consider sycamore the best wood available for the piece forming the sides of octagon berry boxes. This type of box is shown in Plate III. The piece forming the sides must be bent in eight places, and, in order that it may bend successfully, a V-shaped scoring is made across the piece for one-half its thickness. The scoring, therefore, is not merely a rough scratch, as in the ordinary berry box. This type of berry box is used in the western United States mainly for fancy berries, and it displays the fruit well. It is made in pints and half pints, the latter mainly for red raspberries. The sides and bottoms must be first dried in order that they may be shipped flat. They are later bent in the dry state when the boxes are assembled. Sycamore, when dry, will stand such treatment without breaking more successfully than almost any other wood. Its good appearance is also a strong point in its favor. Yellow poplar is a good wood for this purpose, but it is much higher priced. The average price paid for sycamore for baskets and fruit packages in Illinois was $11.56 per 1,000 board feet, as compared with $18.22 for yellow poplar.

There are at least two serious objections to the use of sycamore for shipping boxes. An extremely light-colored wood, on which stenciling and writing show well, is usually preferred, since manufacturers often advertise their products on the boxes in which they are shipped. Its relatively greater weight, in comparison with many other suitable woods, is another objection, as it increases shipping costs. The use of sycamore for boxes is, therefore, usually confined to certain smaller ones, such as have been described.

The following States use the largest amounts of sycamore in the manufacture of boxes and crates of all kinds: Kentucky, Missouri, North Carolina, Virginia, Arkansas, and Illinois. Reports show a use of over a million feet annually in each of these States. Indiana also uses large, but less amounts in this industry. All of these States, with the exception of North Carolina and Virginia, have



BERRY BOX, OCTAGON FORM.

Piece forming the sides is of sycamore. It bends at scorings without breaking. At top, bottom piece of red gum.

SLATS OF SYCAMORE FOR BACKS OF LOW-PRICED CHAIRS.

Sycamore holds its shape, finishes easily, and has a good appearance.

large supplies of sycamore readily available. The tobacco interests are responsible for the large amounts used in the two last-mentioned States. More than half of the approximately one million feet of sycamore reported by Illinois factories went into baskets and fruit packages.

Sycamore seems to stand small chance as box material in the future in competition with red gum, on account of the large amounts of red gum readily available. The amount of sycamore reported for this industry (approximately 17,000,000 feet) is small in comparison with the 409,000,000 feet of red gum reported; and there is probably less sycamore being used now than when this amount was reported. An average cost of $16.50 per 1,000 board feet at the factory was reported for sycamore for boxes and crates, as compared with about $14 for red gum. The fact that somewhat more is paid for sycamore than for red gum for these uses shows that there is still a good demand for sycamore.

SLACK COOPERAGE.

Statistics of the Bureau of the Census on the slack cooperage industry for 1909 show a production of 17,831,000 sycamore staves and 661,000 sets of sycamore heading in that year. Forest Service statistics for 1918 give a production of 21,384,000 staves and 319,000 sets of heading, an equivalent of over 7,000,000 board feet. Sycamore is a good wood for staves and heading for the same reason as for boxes. It makes a clean, good-looking, strong barrel, and is, therefore, in demand for sugar and flour barrels, especially for the former, which are used more than once. Staves of the highest grade go principally into these two kinds of barrels. They must have a clean appearance and must make a tight joint. The sycamore stave fulfills these requirements and has the additional advantage of holding the hoop well because it has a slightly roughened surface.

Slack staves are cut out from steamed bolts. They are brought against the knife by a carriage which is pivoted and moves in the arc of a circle, giving the staves their curved form. They are cut nearly or quite on the quarter, which gives a minimum amount of warping and splitting, since shrinkage in the radial direction is much less than in the tangential. The edges of the staves must be cut at a slight angle in order to make a fairly tight joint. This is now done by a band saw instead of a knife, as formerly, since the knife leaves more or less ragged edges.

Sycamore staves of high grade are generally a little lower priced than elm staves and a little higher than gum. Number 2 grade is usually made up of mixed woods and is used in barrels for packing crockery, glassware, and provisions of various kinds.

The following States reported relatively large amounts of sycamore slack cooperage manufactured: Missouri, Arkansas, Kentucky, Illi-

nois, Indiana, and Tennessee. The principal supply of sycamore also comes from these six States. Sycamore slack cooperage stock is evidently, therefore, manufactured near the source of supply.

FURNITURE AND FIXTURES.

The greater part of the sycamore employed in furniture and fixtures is in the form of plain-sawed lumber. Much of it is manufactured into common furniture, such as is used for kitchens, pantries, porches, and verandas. Slats for the backs of cheap chairs are made of sycamore (Plate IV). Large quantities of these chairs are made in the lower Ohio Valley. Elm and red gum are used for this purpose along with sycamore, because they all hold their shape well after they are steamed and bent. Light and dark pieces are kept separate and not used together in the same chair, since this detracts from its appearance. Factories making cheap chairs generally use much low-grade material.

Since it does not impart taste, odor, or stain, sycamore is used for shelving, sides, and bottoms of kitchen cabinets, and for refrigerators. Of the total amount reported for this industry, 340,000 feet were used in the manufacture of kitchen furniture, including kitchen tables. There is some objection to its use for the tops of such tables, on account of its liability to warp.

Sycamore constitutes a not inconsiderable portion of the interior and hidden parts of more expensive furniture. It is very useful for drawer sides, backs and bottoms, shelves and pigeonholes, partitions and compartments, guides, and linings. It is also used as core material on which veneer is glued. It finds place in such situations, because it is not a high-priced wood and not because of any superiority over many other woods used with it or replaced by it.

Quarter-sawed sycamore for outside pieces is higher-class material and is used for the same purpose as more expensive woods. Quarter sawing produces a different effect in sycamore from that in most of the oaks because of its dark-colored medullary rays. The so-called "silver grain," which in oak is lighter than the rest of the wood, in sycamore is darker, producing a peculiar effect which is often admired. The quarter-sawed stock is used in solid pieces and in the form of veneer, and is frequently made into panels. Sycamore is also cut into plain veneer for panelwork.

Sycamore in one form or another is used in practically all classes of furniture. A large demand comes from makers of bureaus, chiffoniers, bedsteads, folding beds, tables, china closets, music cabinets, bookcases, and filing cabinets. Sycamore is also used for office fixtures and furniture, for which the quarter-sawed wood is especially appropriate.

An average price of about $23 per 1,000 board feet at the factory was reported for raw material for this class of uses. This is a higher

price than was reported for red gum for the same uses, but considerably less than for birch and maple.

PLANING-MILL PRODUCTS, SASH, DOORS, BLINDS, AND GENERAL MILLWORK.

The striking figure shown by sycamore when quarter-sawed makes a demand for it for planing-mill products, sash, doors, blinds, and general millwork. Its principal use in this industry is for the interior finish of houses and stores, including flooring. It is also used in considerable amounts for cabinetwork. One of the most showy uses of quarter-sawed sycamore is for mantels where panels, columns, brackets, shelves, and tops are combined. Stair rails, newel posts, spindles, capitals, and grillwork call for some of the best grades of this wood. There is also a demand for it for sash and blinds.

Sycamore is desirable for doors, casing, and base. It is much in favor at the present time for door panels in the form of plain veneer. Sycamore panels of built-up veneer are preferable to those of solid wood because of the tendency of the solid wood to warp and twist. Some figure can be obtained in the plain wood, but in order to get the striking figure effects peculiar to the wood it must be quartered. The sycamore door panel is said to go well with a pine frame, a birch frame, or a frame veneered with sycamore.

Sycamore is used in largest amounts for these purposes in Illinois, Ohio, and Tennessee. Prices reported for sycamore lumber used for this class of products averaged approximately the same as those for furniture and fixtures—about $23 per 1,000 feet f. o. b. the factory.

BUTCHERS' BLOCKS.

One of the important uses of sycamore for many years has been for the butcher's block, which usually consists of a bolt of the desired size sawed from the trunk of a tree. It is sometimes mounted on stout legs. Sycamore is selected for this article because it does not split or check readily in seasoning. Some checking, however, takes place and the block, therefore, becomes insanitary. Built-up maple blocks composed of thoroughly seasoned pieces held together by glue and bolts have largely displaced the sycamore block. One of the common methods used in making the sycamore block is to bore out a large hole in the center and drive in a large round plug. This has the effect of closing up checks and shakes in the wood. Large logs with ring shakes are utilized by this method. It is doubtful, however, whether such defective material makes a very satisfactory meat block.

Practically all of the 1,600,000 board feet of sycamore reported for butchers' blocks is credited to Illinois. The present annual use is doubtless much less on account of the substitution of the maple block. About 2,000,000 feet of maple was reported as consumed annually on the United States for the same purpose. The cost of

material for sycamore blocks is low, since they are made directly from the log. The average price reported was approximately $12 per 1,000 board feet at the factory. This is the lowest cost of sycamore reported for any industry.

MUSICAL INSTRUMENTS.

Over 300,000 feet of sycamore was reported as used annually for musical instruments. It is largely utilized for the interior frame parts and braces of pianos and organs because of its fair degree of strength and its moderate cost. Quarter-sawed wood is occasionally used for the outside cases. The average price reported for these purposes was $15 per 1,000 board feet. This is about $3 per 1,000 below the average price reported and indicates that not much of the higher grades of lumber was used.

AGRICULTURAL IMPLEMENTS.

Sycamore is used for parts of agricultural implements mainly on account of its availability and not because it has any particular qualifications for such purposes. Its use is principally for minor parts of such implements as thrashing machines, including hoppers, compartments, boxes, and chutes. For these products 290,000 board feet were reported as used annually.

CARPET SWEEPERS.

The greater part of the sycamore reported for carpet sweepers went into the outside pieces of the cases because of the peculiar and attractive figure of sycamore when quarter-sawed. An unusually high average price, $32, was reported for sycamore used for these articles, showing that for the most part a high quality of wood was demanded.

TRUNKS.

Sycamore is used in trunks chiefly for the slats. Elm makes the best trunk slat on account of its excellent shock-resisting ability. Sycamore possesses this quality to a less degree but is a fairly satisfactory substitute.

SHADE ROLLERS.

Curtain poles and Venetian blinds are often made of sycamore wood. Its good finishing qualities make it popular for such products. For the 202,000 board feet reported, an average price of $15.40 was paid.

HANDLES.

Sycamore is sometimes made into long handles of light agricultural tools, such as hoes and rakes. For such purposes it is, however, inferior to other woods more commonly used for these products, such as ash and hickory. Saw handles are also occasionally made of sycamore. A low average price, $14, was paid for sycamore used for these products.

SEWING MACHINES.

Sewing-machine cabinets are often made of sycamore. It is used chiefly in the form of quartered wood for the outside finish. This makes an attractive cabinet because of the striking figure, and its appearance is generally admired. Plain-sawed wood is also used, which is usually finished like oak and birch. The average price reported for sycamore by manufacturers of sewing machines was $18 per 1,000 board feet.

WOODENWARE AND NOVELTIES.

Under woodenware and novelties are included a large number of small articles that can not be properly classified under the other industries. Important among these articles are paper-roll plugs (fig. 3). They are connected in pairs by a stick and are used for hold-

FIG. 3.—Paper roll plugs of sycamore connected by a cylindrical piece of softwood. Used for holding rolls of wrapping paper.

ing rolls of paper, chiefly wrapping paper, for grocers, druggists, and others. Of all the woods commonly used for this purpose, sycamore is said to be the most suitable because it readily takes a smooth finish, has a clean appearance, and is very cheap. Maple is also a good wood for this use, except that it is more expensive. Gum, elm, and ash are also commonly used. Slabs are cut into squares, which are run through a machine. The ends of the squares are rounded and tapered, bored out, and cut off by this machine. The plugs are dried and polished by being rolled against each other, the friction giving them a smooth finish. They are turned out in carload quantities. The other articles included under this heading—cheese supports and stereoscopes—are made only occasionally of sycamore. A low average price, $13 per 1,000 board feet at the factory, was reported by manufacturers for these uses.

OTHER FACTORY USES.

Sycamore is used in a small way by a large number of other wood-using industries. The entire amount reported was only about 1 per cent of the total. This went into toys, brush blocks, vehicles, ships and boats (chiefly for the inside finish), saddles and ox yokes, sporting and athletic goods, picture frames and molding, and washing-machine parts. Sycamore is used to a limited extent for second-grade axles,

poles, and reaches of vehicles, but is much inferior to species more commonly used for these parts, as hickory and oak.

FUEL.

Sycamore trees are well adapted for conversion, wholly or in part, into fuel wood because they are to a great extent made up of large limbs which are not suitable for other purposes. Sycamore wood, however, does not have so high a heating value as many other woods, as, for instance, oak and beech. A standard cord of these, made up of 4-foot sticks in a pile 8 feet long and 4 feet high, is approximately equivalent in heating value to 1 ton of coal. About 1½ standard cords of sycamore are necessary to give the heating value of 1 ton of coal. This puts sycamore in the class of red gum and soft maple.

No statistics are available on the amount of sycamore used for fuel. Since the tree is so widely distributed and is quite prevalent along streams and on overflow land which can not be cultivated, and since, moreover, the wood is not especially difficult to convert into cordwood and is a satisfactory fuel wood, considerable quantities are doubtless used locally by farmers for this purpose.

LUMBER AND TIMBER VALUES.

LUMBER PRICES.

The average value of sycamore lumber f. o. b. mills is secured by the Forest Service from manufacturers' reports on annual lumber production. This value is given, by States and years, in Table 7.

TABLE 7.—*Average value of sycamore lumber per 1,000 board feet f. o. b. mills, in different States, for different years.*

State.	1899	1904	1907	1908	1909	1910	1911	1915	1916	1917	1918
United States	$11.04	$13.16	$14.58	$14.67	$14.77	$14.10	$13.16	$13.86	$14.65	$18.68	$23.59
Arkansas	9.49	9.49	13.10	12.78	15.27	12.81	12.21	13.72	12.73	16.28	23.29
Indiana	12.05	14.26	16.71	17.78	17.20	16.65	15.19	14.36	18.15	22.01	29.05
Tennessee	9.75	12.65	14.70	12.67	13.15	12.21	12.04	12.66	12.51	20.97	22.12
West Virginia	12.00	.....	14.42	15.24	13.48	13.75	.....	15.73	17.15	16.59	20.26
Kentucky	11.20	11.05	13.14	13.33	12.87	11.65	11.66	13.17	14.48	16.64	21.35
Ohio	12.55	14.65	16.92	16.46	18.08	17.38	15.02	15.53	18.53	21.13	26.80
Missouri	9.74	12.81	12.43	13.01	13.12	13.37	12.05	14.55	14.10	16.55	19.48
Illinois	10.19	14.13	15.25	13.60	14.94	14.68	16.93	14.88	14.23	23.62	23.04
Virginia	11.49	.....	11.54	12.35	10.91	.....	11.67	11.28	9.45	15.69	20.05
Mississippi	10.00	14.36	10.00	11.75	14.30	12.45	.....	12.11	15.47	16.94	24.63
Oklahoma	14.00	11.53	13.88	12.81	12.52	12.40	12.31	11.83	13.57	17.10	20.11
North Carolina	.....	.....	15.82	10.00	11.44	13.75	14.15	12.03	11.68	16.93	24.24
Maryland	.....	.....	18.00	10.53	11.67	13.92	12.20	11.37	11.29	14.47	21.93
Louisiana	.....	.....	11.00	.....	12.11	12.00	.....	.....	14.25	19.08	23.98
Georgia	.....	.....	.....	12.51	14.74	11.56	11.50	.....	16.22	18.56	24.21
South Carolina	.....	12.00	8.00	15.00	13.10	.....	.....	14.00	13.65	16.00	24.00
Pennsylvania	.....	18.71	16.95	14.59	15.01	15.75	13.87	15.97	17.68	17.40	26.64
Michigan	11.33	21.32	15.74	17.41	16.35	16.27	14.33	19.58	18.27	22.34	25.00
Iowa	15.00	20.00	.....	19.00	22.73	18.63	18.50	17.21	19.67	21.25	25.00
Alabama	.....	10.43	.....	10.00	12.76	14.00	9.13	13.57	13.97	21.40	21.16
New York	15.36	.....	.....	.....	.....	15.00	.....	16.00	20.00	17.75	19.44
Texas	.....	.....	.....	16.00	17.00	15.13	.....	14.02	15.00	19.46	22.51
Kansas	13.28	.....	.....	.....	16.00	16.67	.....	.....	17.50	15.00	16.50
Connecticut	.....	.....	20.00	14.59	19.90	.....	.....	15.00	14.50	18.00	32.19
New Jersey	.....	.....	.....	30.00	17.47	.....	.....	16.50	17.50	35.00	40.00

The present wholesale prices of different grades of plain and quarter-sawed sycamore lumber in the principal centers of its distribution are given in Table 8.

STUMPAGE AND LOG PRICES.

Figures showing the value of standing sycamore timber for different years are not available. Since the tree occurs in such small stands and is usually cut along with other species, a fair price for the sycamore alone is difficult to determine.

Cooperage factories find it to their advantage to buy tracts of mixed hardwood timber at a convenient distance and cut and bring it to the mill. Such timber tracts have sold in Arkansas for $1.50 per 1,000 board feet log scale, including sycamore and several other species. In normal times the sycamore has been logged and transported by railroad to the factory at a cost of from $5 to $6 per 1,000 board feet, making a total cost to the factory of about $7 per 1,000. Factories similarly situated and not owning their timber have generally paid from $2 to $3 more per 1,000 board feet for sycamore. High-grade sycamore logs cost considerably more.

TABLE 8.—*Average wholesale prices of 1-inch sycamore lumber in representative centers of its distribution and utilization, by quarter years.*

[Prices furnished by the Lumbermen's Bureau.]

Centers.	1917				1918				1919			
	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
NEW YORK.												
4/4 plain:												
Firsts and seconds	$38.33	$40.00	$43.00	$43.00	$43.33	$44.83	$46.50	$41.83	$44.50	$50.50	$52.83	$61.67
No. 1 common	28.00	31.00	34.00	34.00	34.33	35.83	37.83	36.83	39.50	40.50	36.17	41.67
No. 2 common	23.50	25.67	28.00	28.00	28.33	29.83	31.50	31.83	34.50	30.50	32.83	40.67
No. 3 common	19.17	20.67	29.00	29.00	29.33	30.83	32.50	30.17	29.50	.....	.....	.....
Log run	28.50	31.67	34.00	34.67	35.33	36.83	38.50	36.83	39.50	39.50	43.50	51.67
4/4 quartered:												
Firsts and seconds	53.00	55.67	54.00	53.67	53.00	53.85	56.50	59.83	62.50	58.50	62.50	71.67
No. 1 common	42.67	45.67	44.00	43.67	43.00	43.83	46.50	49.83	52.50	48.50	45.83	51.67
NORFOLK & RICHMOND.												
4/4 plain:												
Firsts and seconds	31.67	36.00	39.00	39.00	39.33	40.67	42.50	37.83	40.50	46.50	50.17	59.67
No. 1 common	24.00	27.00	30.00	30.00	30.33	31.67	33.83	32.83	36.17	36.50	40.17	49.67
No. 2 common	18.17	21.67	24.00	24.00	24.33	25.67	27.50	27.83	30.50	26.50	33.17	48.67
No. 3 common	14.17	16.67	20.00	20.00	20.33	21.67	23.50	22.83	25.50	.....	.....	.....
Log run	24.50	27.67	30.00	30.67	31.33	32.67	34.50	33.17	36.50	36.50	41.17	49.67
4/4 quartered:												
Firsts and seconds	47.00	49.67	50.00	49.67	49.00	49.67	52.50	55.83	58.50	54.50	63.17	79.67
No. 1 common	42.33	39.67	40.00	39.67	39.00	39.67	42.50	45.83	48.50	44.50	53.17	69.67
EVANSVILLE.												
4/4 plain:												
Firsts and seconds	32.17	34.17	37.00	37.00	37.33	38.83	40.50	35.83	38.50	44.50	45.83	54.00
No. 1 common	23.17	25.17	28.00	28.00	28.33	29.83	31.83	30.83	33.50	34.50	35.50	43.67
No. 2 common	16.33	18.83	22.00	18.00	18.33	19.83	22.83	25.83	28.50	24.50	25.50	32.67
No. 3 common	12.33	14.83	18.00	28.00	28.33	29.83	28.17	20.83	23.50	.....	.....	.....
Log run	29.83	25.33	28.00	.....	.....	.....	.....	.....	34.50	34.50	36.50	43.67
4/4 quartered:												
Firsts and seconds	46.67	47.67	48.00	47.67	47.00	47.83	50.50	53.83	56.50	52.50	55.17	63.67
No. 1 common	36.67	37.67	38.00	37.67	37.00	37.83	40.50	43.83	46.50	42.50	45.17	53.67

TABLE 8.—*Average wholesale prices of 1-inch sycamore lumber in representative centers of its distribution and utilization, by quarter years*—Continued.

Centers.	1917				1918				1919			
	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
CHICAGO.												
4/4 plain:												
Firsts and seconds	$33.33	$36.00	$39.00	$39.00	$39.33	$40.83	$43.00	$38.33	$41.60	$47.00	$49.00	$57.67
No. 1 common	24.33	27.00	30.00	30.00	30.33	31.83	34.33	33.33	36.00	37.00	39.00	47.67
No. 2 common	20.50	21.67	24.00	24.00	24.33	25.83	28.00	28.33	31.00	27.00	29.00	36.67
No. 3 common	16.50	17.67	20.00	20.00	20.33	21.83	24.00	23.33	26.00	.....	.....	.....
Log run	24.83	27.67	30.00	30.67	31.33	32.83	35.33	34.33	37.00	37.00	33.33	37.67
4/4 quartered:												
Firsts and seconds	48.33	49.67	50.00	49.67	49.00	49.83	53.00	56.33	59.00	55.00	58.67	67.67
No. 1 common	38.33	39.67	40.00	39.67	39.00	39.83	43.00	46.33	49.00	45.00	48.67	57.67
ST. LOUIS.												
4/4 plain:												
Firsts and seconds	31.50	33.50	36.50	36.50	36.83	38.33	40.00	35.33	38.00	44.00	46.00	54.67
No. 1 common	22.50	24.50	27.50	27.50	27.50	28.33	30.33	29.33	32.67	34.00	36.17	45.17
No. 2 common	16.67	19.17	21.50	21.50	21.83	23.33	25.00	25.33	28.00	24.00	26.00	33.67
No. 3 common	12.67	15.17	17.50	17.50	17.83	19.33	21.00	20.33	23.00	.....	.....	.....
Log run	23.00	25.17	27.50	27.50	27.83	29.33	31.33	30.33	33.67	34.00	37.20	44.67
4/4 quartered:												
Firsts and seconds	46.17	47.17	47.50	47.50	46.50	47.33	50.00	53.33	56.00	52.00	55.67	64.67
No. 1 common	36.17	37.17	37.50	37.50	36.50	37.33	40.00	43.33	46.00	42.00	45.67	54.67
KANSAS CITY.												
4/4 plain:												
Firsts and seconds	34.17	35.50	38.00	38.00	38.33	39.83	42.00	37.33	40.00	46.00	48.00	56.67
No. 1 common	25.17	26.50	29.00	29.00	29.33	30.83	33.33	32.33	35.00	36.00	38.00	43.33
No. 2 common	18.33	20.17	23.00	23.00	23.33	24.83	27.00	27.33	30.00	26.00	28.00	35.67
No. 3 common	14.33	16.17	19.00	19.00	19.33	20.83	23.00	22.33	25.00	.....	.....	.....
Log run	26.17	27.00	29.00	29.67	30.33	31.83	34.00	32.33	35.00	35.00	38.67	46.67
4/4 quartered:												
Firsts and seconds	48.67	49.00	49.00	49.00	48.00	48.83	52.00	55.33	58.00	54.00	57.67	66.67
No. 1 common	38.67	39.00	39.00	39.00	38.00	38.83	42.00	45.33	48.00	44.00	47.67	56.67
LOS ANGELES, SAN FRANCISCO, AND SEATTLE.												
4/4 plain:												
Firsts and seconds	54.33	56.00	52.00	52.00	52.33	53.83	58.67	59.33	62.00	68.00	68.00	75.67
No. 1 common	.....	40.50	43.00	43.00	43.33	44.83	49.00	52.00	56.00	57.00	57.50	65.67
No. 2 common	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 3 common	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Log run	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4/4 quartered:												
Firsts and seconds	61.67	62.67	63.00	63.00	62.00	62.83	67.67	74.33	77.00	73.00	74.50	85.67
No. 1 common	.....	52.50	53.00	53.00	52.00	52.83	57.67	64.33	67.00	63.00	64.50	75.67
CAIRO AND THEBES.												
4/4 plain:												
Firsts and seconds	29.83	32.50	35.50	35.50	35.83	37.17	38.00	33.33	36.00	42.00	44.25	54.17
No. 1 common	20.83	23.50	26.50	26.50	26.83	28.17	29.33	28.33	31.00	32.00	34.25	44.17
No. 2 common	17.00	18.17	20.50	20.50	20.83	22.17	23.00	23.33	26.00	22.00	24.25	33.17
No. 3 common	13.00	14.17	16.50	16.50	16.83	18.17	19.00	18.33	21.00	.....	.....	.....
Log run	24.00	24.17	26.50	27.17	27.83	29.17	30.33	29.33	32.00	32.00	34.25	44.17
4/4 quartered:												
Firsts and seconds	44.83	46.17	46.50	46.50	45.50	46.50	48.00	51.33	54.00	50.00	52.25	64.17
No. 1 common	34.83	36.17	36.50	36.50	35.50	36.17	38.00	41.33	44.00	40.00	42.25	54.17
MEMPHIS.												
4/4 plain:												
Firsts and seconds	27.67	30.00	33.00	33.00	33.00	34.83	35.50	30.83	33.50	37.87	41.17	49.67
No. 1 common	18.67	21.00	24.00	24.00	24.00	25.83	26.83	25.83	28.50	29.50	31.17	39.67
No. 2 common	14.83	15.67	18.00	18.00	18.00	19.83	20.50	20.83	23.50	19.50	21.17	26.00
No. 3 common	10.83	11.67	14.00	14.00	14.00	15.83	16.50	15.83	18.50	.....	.....	.....
Log run	20.17	21.67	24.00	24.67	25.00	26.83	27.83	26.83	29.50	29.50	32.17	39.67
4/4 quartered:												
Firsts and seconds	42.67	43.67	44.00	43.67	43.00	43.83	45.50	48.83	51.50	47.50	50.83	59.67
No. 1 common	32.67	33.67	34.00	33.67	33.00	33.83	35.50	38.83	41.50	37.50	40.83	49.67

TABLE 8.—*Average wholesale prices of 1-inch sycamore lumber in representative centers of its distribution and utilization, by quarter years*—Continued.

Centers.	1917.				1918.				1919.			
	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
LOUISVILLE.												
4/4 plain:												
Firsts and seconds	.....	$34.50	$37.00	$37.00	$37.00	$38.83	$40.50	$35.83	$38.50	$44.50	$45.83	$54.17
No. 1 common	.....	25.50	28.00	28.00	28.00	29.83	31.83	30.83	33.50	34.50	35.50	43.67
No. 2 common	.....	19.75	22.00	18.00	18.00	19.83	22.83	25.83	28.50	24.50	25.50	32.67
No. 3 common	.....	15.75	18.00	28.00	28.00	29.83	28.17	20.83	23.50	.....	.....	.....
Log run	$22.00	24.50	28.00	.....	.....	.....	31.50	30.50	34.50	34.50	36.50	43.67
4/4 quartered:												
Firsts and seconds	.....	47.50	48.00	47.67	47.00	47.83	50.50	53.83	56.50	52.50	55.17	63.67
No. 1 common	.....	37.50	38.00	37.67	37.00	37.83	40.50	43.83	46.50	42.50	45.17	53.67

Sycamore logs are often secured in rafts, but the price does not differ greatly from that of logs delivered by railroad. In the region of Cairo, Ill., it is said to cost about $5 per 1,000 board-feet log scale to bring the timber to the factory from points up the rivers where it is collected.

MARKETS.

Sycamore is usually sold in the log, since factories consuming large amounts can generally make use of it to best advantage in that form. Much of it is marketed in rafts to factories on the lower Ohio and Mississippi Rivers. It has often been sold to factories in mixture with other species, such as red gum, cottonwood, elm, and ash, for from $8 to $10 per 1,000 board-feet log scale for all species. Stave and heading factories have generally paid from $10 to $12 per 1,000 for sycamore logs of fairly good quality, but the price is quite variable, depending for the most part on the quality.

Factories do not usually care for sycamore logs larger than 24 inches in diameter at the most; for the larger logs are likely to have ring shakes, hollow centers, and hidden defects. Basket factories prefer a diameter of from 16 to 20 inches, although they can often use sizes as small as 10 inches. Stave factories can use small logs to good advantage and prefer sizes that measure between 10 and 15 inches in diameter when cut into bolts. Factories making berry boxes and tobacco boxes afford the best markets for sycamore logs of good quality. In these markets they should bring from $15 to $20 per 1,000 board feet in normal times. Some factories have paid as much as $22 per 1,000 for high grade logs. Sycamore logs can usually be sold to chair factories at a fairly good price. Large defective logs could formerly be disposed of to makers of butchers' blocks, but so few of the old-fashioned sycamore blocks are now made that there is practically no market for them for this purpose. The best way to dispose of such logs, if they are not too defective, is to convert them into lumber.

Furniture and tobacco box factories afford a good market for sycamore lumber. They generally use 4/4 and 5/4 plain sycamore of the No. 1 common and better grades. Furniture factories generally use quartered stock. Manufacturers of cheap chairs can utilize low-grade lumber. They buy thick planks and use all grades except cull. Planing-mill, sash, door, blind, and general millwork factories often use sycamore in the form of lumber.

GRADING RULES.

Sycamore lumber is graded under the National Hardwood Lumber Association Rules. There are separate classifications for plain and quartered sycamore. Lengths are from 4 to 16 feet, but not over 15 per cent of odd lengths are admitted. Thicknesses are $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, and 6 inches. Widths are 3 inches and over.

Plain sycamore is graded under the same rules as beech, birch, hard maple, and hackberry, and the grades are as follows: Firsts, seconds, selects, No. 1 common, No. 2 common, wormy, and No. 3 common. Inspection is made on the poor side of each piece. Firsts are 6 inches and over wide, 8 feet and over long, and pieces with 4 to 9 feet surface measure must be clear. Larger pieces can have one or two standard defects, depending on the size of the piece. Seconds are 6 inches and over wide, 8 feet and over long, and can have from one to five standard defects according to size of the piece. Firsts and seconds are generally combined as one grade and designated as "FAS." In this combined grade not more than 20 per cent of the pieces can be under 12 feet long and not more than 10 per cent of 8 and 9 foot lengths are allowed. Selects are 4 inches and over wide, 6 feet and over long, admitting 30 per cent under 12 feet long and 5 per cent of 6 and 7 foot lengths. In general, pieces in this grade must be practically or nearly clear on the best face and the reverse side must be up to the No. 1 common grade. No. 1 commons are 3 inches and over wide, with not to exceed 5 per cent of 3-inch widths, and 4 feet and over long, with not over 30 per cent shorter than 10 feet and not to exceed 10 per cent of 4 and 5 feet lengths. Pieces 4 and 5 feet long, and 3 and 4 inches wide 6 and 7 feet long must be clear. Larger pieces must work $66\frac{2}{3}$ per cent clear face in not over 2, 3, or 4 cuttings depending on width and length of piece with specified minimum sizes of cuttings. No. 2 commons are 3 inches and over wide, 4 feet and over long, with not more than 10 per cent of 4 and 5 feet lengths admitted. Pieces must work 50 per cent clear face in not over 3, 4, or 5 cuttings (not less than 3 inches wide and 2 feet long) according to size of piece. In wormy grade pin-worm holes are not considered a defect, and it is a combination of all grades included in No. 2 common and better. No. 3 commons are 3 inches and over wide, 4 feet and over long, and each piece must contain at least 25 per cent of sound cuttings of a minimum width of $1\frac{1}{2}$ inches and a minimum area of 36 square inches.

The grading rules for quarter-sawed sycamore are the same as for plain-sawed except that the combined grade of firsts and seconds and selects must show figure on one face not less than 90 per cent in the aggregate and the cuttings in No. 1 common and No. 2 common must show figure on one face. There is a slight difference also in the grade No. 1 common, the rules for plain sycamore allowing a large number of cuttings in the longest pieces.

Association log grades have not been formulated for sycamore, since it is so largely purchased for special uses, and the value of any particular log depends to a great extent not only upon its size and quality but also upon what is to be manufactured from it.

SUMMARY AND CONCLUSIONS.

Although neither a high-priced nor a plentiful wood, sycamore is well regarded for certain uses. It is particularly in demand for such containers as slack barrels and plug-tobacco boxes because it does not impart stain, taste, or odor, has a clean and pleasing appearance, is fairly strong, and works and seasons well. Quarter-sawed material is desirable for the outside finish of various products.

There would be a good market for sycamore if a sufficient and constant supply could be assured. However, on account of the occasional occurrence of the timber the supply is irregular, and recently there seems to have been less of it available than in former years. Red gum is being substituted for sycamore to a very large extent for tobacco boxes and slack staves, and, with improved methods in working and seasoning, has proved satisfactory to a degree, although it does not present so good an appearance.

There will probably always be considerable though occasional supplies of sycamore available, since the tree occupies flood lands and areas along the streams not suitable for cultivation. Although many other trees are worth more in the market, sycamore is valuable to the agriculturist along streams for keeping his land from washing, and its growth should, therefore, be encouraged in such situations.

Sycamore can usually be most readily disposed of in the log to factories making berry boxes, tobacco boxes, and slack cooperage. Large logs are, as a rule, not so valuable on account of large defects. Furniture factories usually afford the best market for sycamore lumber, both plain and quartered. Factories making inside finish materials also use comparatively large quantities.

Owners of sycamore timber seeking a suitable market for their product should make inquiry as to possible local markets for the raw material, the firms that use it, the form desired at the factory, and the prices paid both for logs and for semi-finished products. They should also obtain information about specifications, the preparation of stock, seasoning, shipping instructions, quotations, etc., from different industries located in their vicinity. For information on local markets or those relatively near by, they should write the forestry officials of their own States.

APPENDIX.

CLASSIFIED LIST OF USES REPORTED FOR SYCAMORE BY FACTORIES.

Agricultural implements.—Agricultural implements, boxes, chutes, compartments, hoppers, thrashing machines.

Boxes and crates.—Basket parts; baskets, fruit; baskets, grape; baskets, stave; baskets, vegetable; bottle, packing; box shooks; boxes; boxes, cigar; boxes, tobacco; boxes, veneer; cases, berry; cases, egg; cases, tobacco; cases, tomato; crates, bottle; crates, onion; crating; heading, fruit package; hoppers, fruit; hoppers, vegetable; packages, fruit; packages, vegetable; slats, fruit package.

Carpet sweepers.—Carpet-sweeper cases, carpet sweepers.

Brushes.—Brush blocks.

Butchers' blocks.—Blocks, butchers'; blocks meat.

Equipment, playground.—Horses, merry-go-round.

Frames and molding, picture.—Frames, picture; molding, picture.

Furniture.—Bin sides, kitchen cabinet; bed slats; beds, folding; bookcases; bureaus; chairs; chiffoniers; china closets; consoles; cores, bank fixtures; cores, store fixtures; counters, bar; desk drawers; desks; drawer backs; drawer bottoms; drawer sides; fixtures, bank; fixtures, office; fixtures, store; foot stools; furniture, bedroom; furniture, case goods; furniture, kitchen; ice boxes; mirror backing; music cabinets; partition, kitchen cabinets; pigeonholes, desk; refrigerators; rockers; shelves, kitchen cabinet; showcases; side rails, bed; stools; table legs; table tops; tables.

Handles.—Handles, hoe; handles, rake; handles, saw.

Musical instruments.—Guitar bodies; mandolin boxes; organ cases; organs, pipe, organs, reed; piano backs; piano cases.

Planing mill products.—Beams, dining-room ceiling; carpet strips; chair rails; ceiling; finish; flat battens; flooring; interior finish; molding; molding, bed; molding, brick; molding, cap; molding, cove; molding, crown; molding, door; molding, house; molding, plaster; molding, quarter-round; molding, screen; molding, spring cove; molding, window; molds, partition; nosing; panel strips; plate rails; sheathing; shelving; siding; trim; wainscot rails.

Saddles and harness.—Ox yokes; saddle trees.

Sash, doors, blinds, and general millwork.—Base blocks; baseboards; base corners; blind stops; blinds; brackets; cabinetwork; colonnades; corner blocks; door casing; door stops; doors; doors, folding; doors, front; doors, sliding; dust caps; fillet; fly screens; frames, door; frames, front door, side light; frames, window; gable ornaments; general millwork; grills; head blocks; head casing; jambs, door; mantels; mirrors; panels; parting stops; sash; sink aprons; stair work; window aprons; window casing; window stops.

Shade rollers.—Curtain poles; Venetian blinds.

Ship and boat building.—Boat parts; boats; cabins, interior, ships and yacnts; finish, boats; ships and boats.

Signs and supplies.—Barber poles.

Slack cooperage.—Heading; staves.

Sporting and athletic goods.—Tennis frame reinforcements.

Toys.—Game boards.

Trunks and valises.—Trunk slats; trunks.

Vehicles and vehicle parts.—Carriages; cart trees; step bars, vehicle bodies; vehicle sides; wagon bottoms; wagon stock.

Woodenware and novelties.—Cheese supports; plugs, paper roll; stereoscopes.

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